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Reference: 004323

March 17, 2005

Mr. Mark Verhey
Humboldt County Division of Environmental Health
100 H Street, Suite 100
Eureka, CA 95501

Subject: Site Investigation/Pilot Study Work Plan, Former Rio Dell Texaco, 100 Wildwood Avenue, LOP No. 12691

Dear Mr. Verhey:

Presented herein is the site investigation / pilot study work plan for the Former Rio Dell Texaco (site) in Rio Dell, California. This report includes a description of the proposed work. This work plan is being prepared at the request of Humboldt County Division of Environmental Health (HCDEH) in a letter dated December 22, 2004.

Vicinity Information

The site is located at 100 Wildwood Avenue in Rio Dell, Humboldt County California, at the northeast corner of the intersection of Wildwood Avenue and Edwards Drive (Figure 1). A site plan is included as Figure 2.

Background

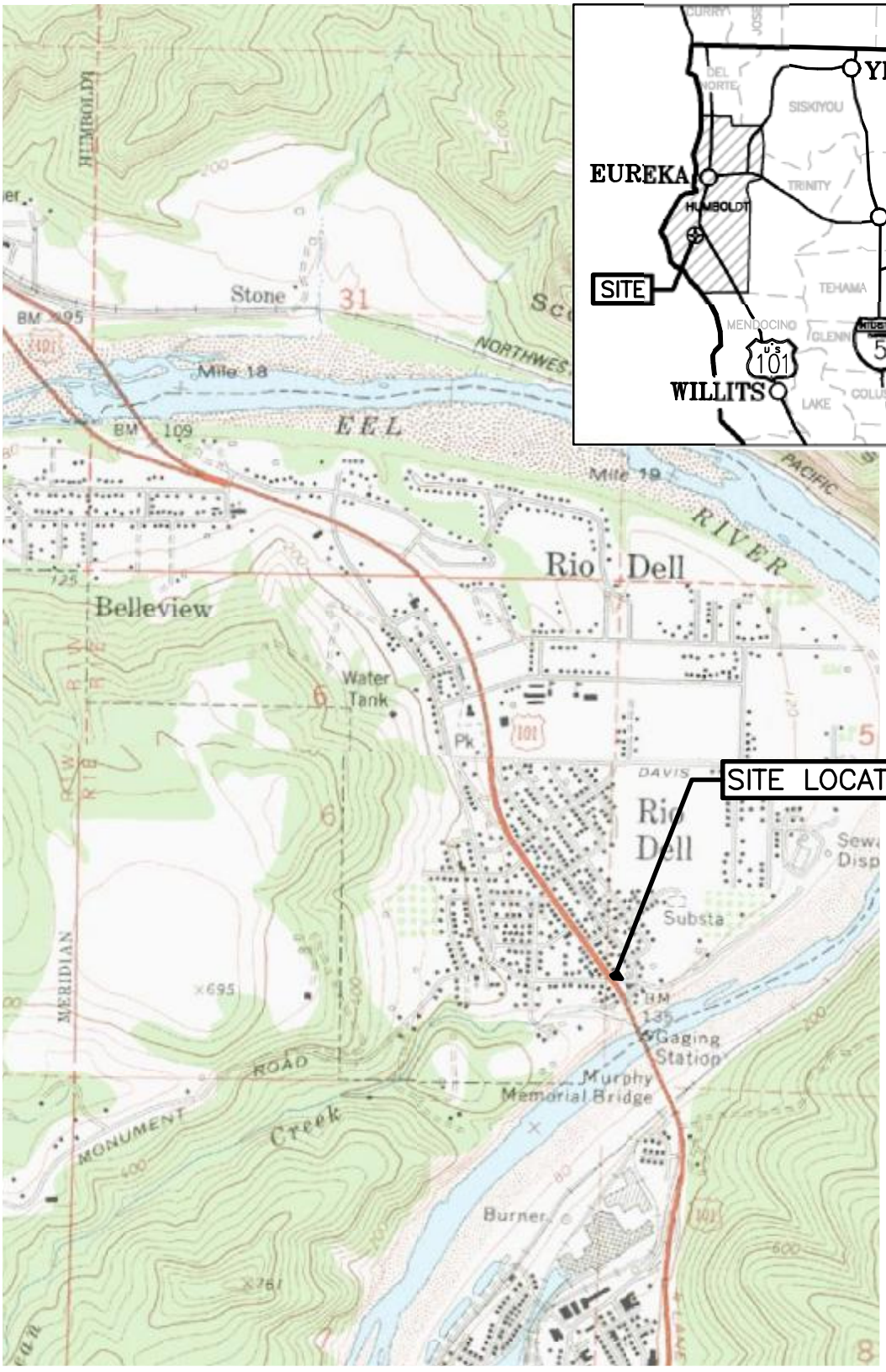
In December 1990, a 200-gallon waste oil Underground Storage Tank (UST) was removed from the site and contaminated soils were excavated from the vicinity of the UST in August 1992. In November 1996, the HCDEH issued a remedial action completion certificate for the waste oil UST (LACO, 2002).

In September and October 1998, Northcoast Environmental Construction removed six Underground Storage Tanks (USTs) from the site. Low concentrations of petroleum hydrocarbons were detected in several soil samples from the excavation cavities (LACO, 1998). In February 2000, LACO Associates (LACO) installed six soil borings (B-1 through B-6) and four monitoring wells (MW-1 through MW-4) at the site, and initiated quarterly groundwater monitoring and sampling (LACO, 2000).

In 2001, LACO performed a sensitive receptor survey for a 1,000-foot radius from the site. Two active wells were located within the search area; one well was reportedly used for irrigation, and the other for domestic use and irrigation. Both wells are located cross-gradient of the site (LACO, February 2002).

In March and April 2002, LACO installed eight additional soil borings / temporary well points (B-7 through B-14) at the site (LACO, June, 2002).

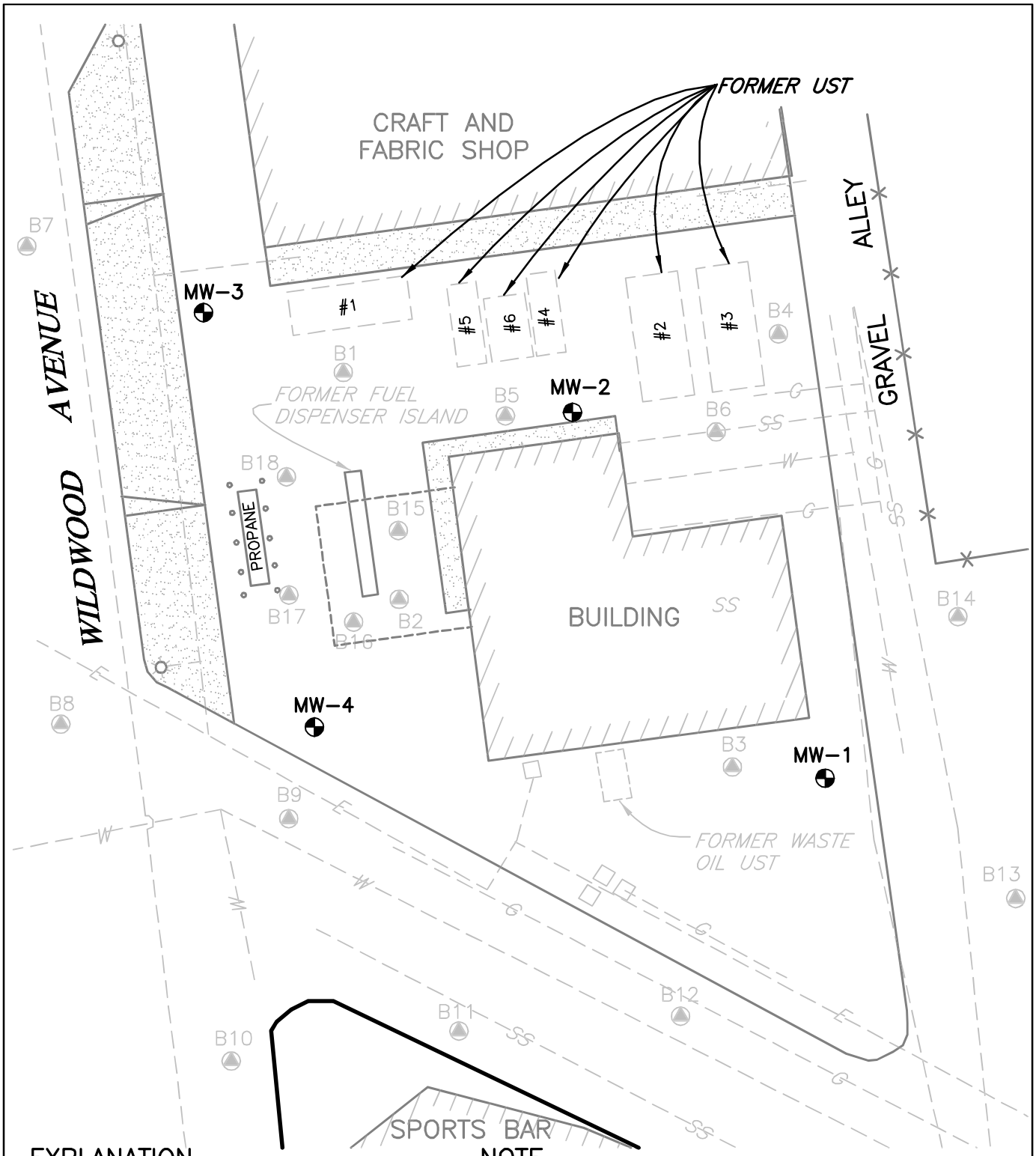
In January 2004, LACO installed four additional soil borings / temporary well points (B-15 through B-18) at the site (LACO, 2004).



SOURCE: SCOTIA AND RIO DELL
USGS 7.5 MINUTE QUADRANGLES

1"=1,500'±

SHN Consulting Engineers & Geologists, Inc.	Former Rio Dell Texaco Rio Dell, California		Site Location Map SHN 004323
	January, 2005	004323-FIG-1	Figure 1



EXPLANATION

MW2 *MONITORING WELL LOCATION AND DESIGNATION*

B14 *SOIL BORING LOCATION AND DESIGNATION*

NOTE

BASE MAPPING, MONITORING WELLS AND SOIL BORING LOCATIONS FROM LACO ASSOCIATES, 9/22/04.

N

1"=20'

SHN Consulting Engineers & Geologists, Inc.	Former Rio Dell Texaco Rio Dell, California	Site Plan SHN 004323	
	January, 2005	004323-FIG-2	Figure 2

Objective

The objective of the proposed work scope is to determine the depth and thickness of the contaminated zone in the area of the former fuel dispenser island, in order to develop a plan to remediate contamination using In Situ Chemical Oxidation (ISCO).

Scope of Work

This scope of work is designed to provide the information needed to meet the objective of this investigation.

- Provide project implementation
- Advance 7 Membrane Interface Probe (MIP) borings
- Advance 5 continuously-cored soil borings
- Collect soil samples from 5 soil borings
- Collect groundwater samples from 3 temporary well points
- Perform a field injection study using potable water as a surrogate for chemicals
- Submit soil and groundwater samples for a chemical oxidation treatability study
- Perform a slug test for aquifer characterization
- Prepare a report of findings

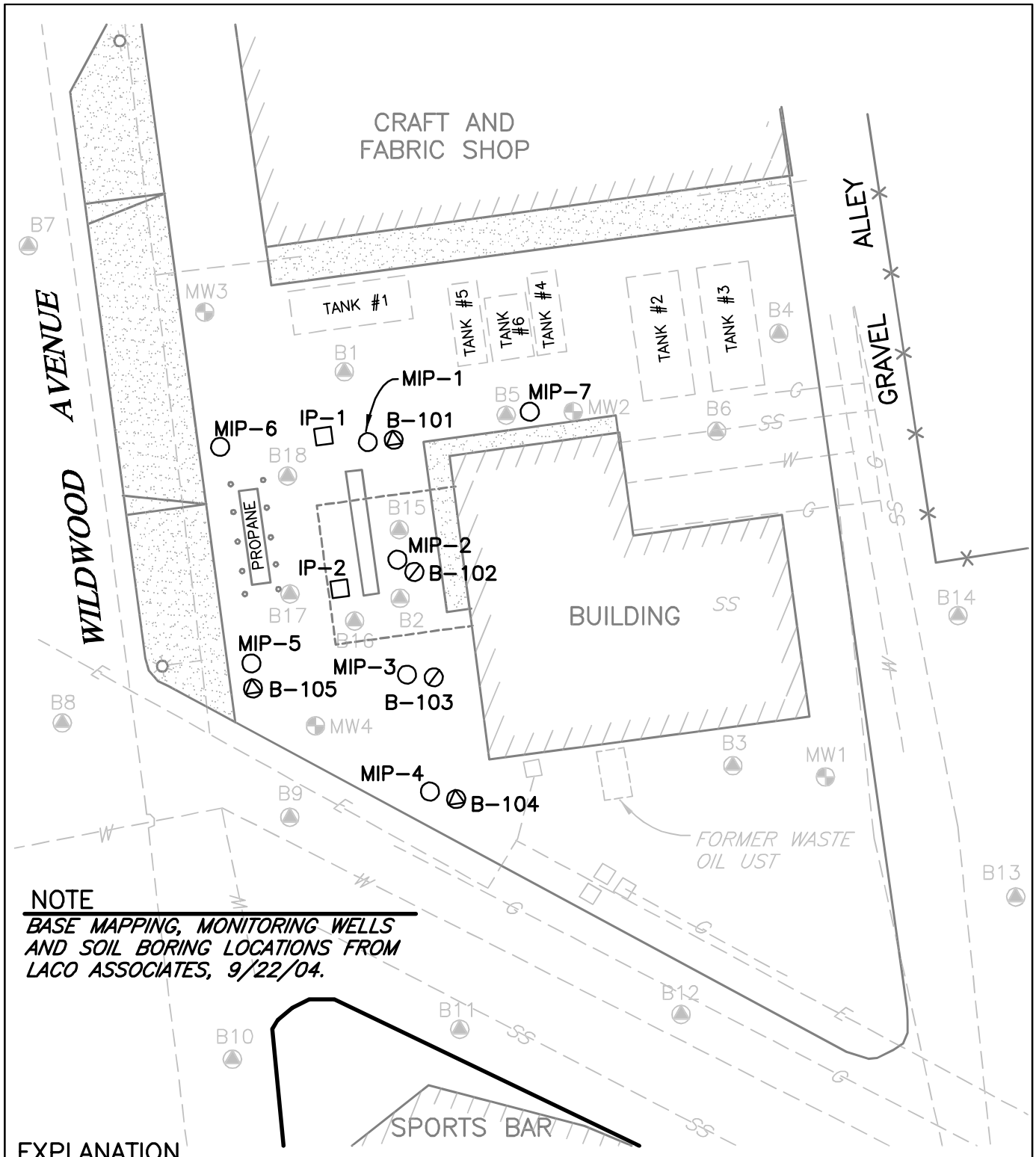
Project Implementation

In addition to providing this work plan, SHN will set up and coordinate all activities related to the project, including obtaining all necessary permits, contacting Underground Service Alert, and corresponding with the HCDEH.

Membrane Interface Borings

We propose installing 7 MIP borings (Figure 3). The MIP borings will be used to determine the depth and thickness of the contaminated zone. The MIP probe consists of a Soil Conductivity (SC) sensor, which measures the electrical conductivity of the soil. In general, low conductivities are indicative of sands, while clays and silts have a higher conductivity. The probe also has a heated block with a permeable membrane. During advancement of the probe, compounds diffuse across the membrane and are carried to detectors via an inert carrier gas. The detectors to be used during this investigation will include a Photoionization Detector (PID) and a Flame Ionization Detector (FID). The PID and FID are used to detect the presence of petroleum hydrocarbons.

In the December 2004 letter from the HCDEH, a request was made for the evaluation of the ability of the MIP to detect MTBE. The MIP can continuously detect both contaminant levels and lithology, but because the sensitivity of MIP is limited (common detection limits are 100 ug/L), it should be used primarily for areas of high contamination (source areas) (ITRC, 2005). The MIP cannot distinguish between individual contaminants present in soil and groundwater, and data derived from the MIP is a measure of relative concentrations of total contamination. The purpose of



Consulting Engineers & Geologists, Inc.	Former Rio Dell Texaco Rio Dell, California	Proposed Investigation Locations SHN 004323	
	February, 2005	004323-FIG-3	Figure 3

using the MIP at the site is to locate the depth and thickness of contamination in the source area, in order to design an effective injection program, which will target areas of high contaminant concentrations.

Upon completion, each MIP boring will be backfilled with bentonite and capped at the surface to match the existing surface.

Additional MIP borings may be advanced if the extent of relatively high concentrations of contamination is not defined by the proposed locations.

Direct Push Soil Borings and Wellpoints

We propose installing 5 soil borings (B-101 through B-105) by direct push technology using a truck-mounted Geoprobe® (Figure 3). The information from the soil borings will be used to help define the extent and concentrations of petroleum hydrocarbons that are present at the site. Additional soil borings may be advanced if the extent of contamination is not defined. Continuous soil samples will be collected using the Geoprobe® Macro-Core or Dual Tube sampling system. Following sample retrieval, a portion of the sample tube will be selected, and the ends of the tube will be sealed using Teflon® tape and plastic end caps. The samples will be labeled with location, depth, date and time of collection, analysis requested, and the sampler's initials. Soil samples will be analyzed as discussed in the Laboratory analysis section.

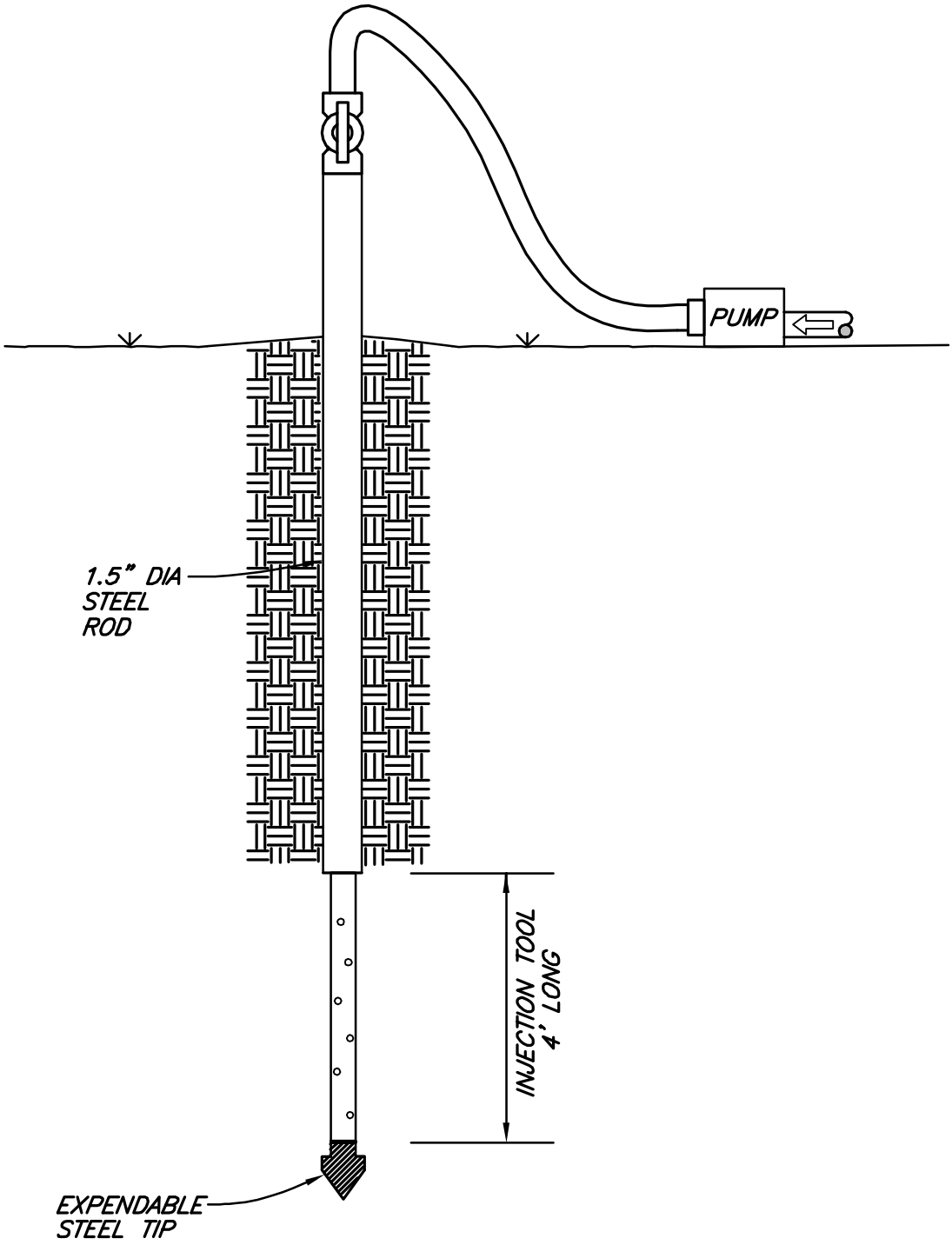
Upon completion of the soil sampling, a temporary well point will be installed in borings B-101, B-104, and B-105 to collect a groundwater sample for chemical analysis. Each well point will consist of 1-inch diameter Polyvinyl Chloride (PVC) casing with 10 feet of PVC screen. Each well point will be developed using surge and purge techniques and sampled with clean disposable tubing with a bottom mounted check valve. Upon completion, each well point will be removed and each borehole will be backfilled with bentonite and capped at the surface to match the existing surface.

Field Injection Study

Two temporary injection borings will be advanced at the site (IP-1, and IP-2), and potable water from the municipal water supply will be used to simulate injection of chemicals. The water will be injected through the use of a four-foot long stainless steel injection tool (Figure 4). Injection backpressures and flow rates at the injection point will be monitored during the test. Approximately 60 gallons of water will be injected at each borehole. Approximately 30 gallons of water will be injected at each of two depths in each boring. The injection depths will be determined from the MIP data. Upon completion of the injection test, the injection point will be removed and each borehole will be backfilled with bentonite and capped at the surface to match the existing surface.

Laboratory Treatability Study

The goal of the treatability study is to determine the optimal volume of chemical required to remediate petroleum hydrocarbons in the subsurface. The chemical dose required is based upon the contaminant mass and the oxidation side reactions, which are site specific. Most oxidizers are non specific oxidants which will not only oxidize the petroleum hydrocarbons eventually into carbon dioxide and water, but will also oxidize any naturally occurring organic material present in



NOTE:
DRIVE DEPTH AND EXPOSED INJECTION TOOL INTERVALS VARY.

Consulting Engineers & Geologists, Inc.	Former Rio Dell Texaco Rio Dell, California	Typical Injection Point SHN 004323
	February, 2005 | 004323-TIP	Figure 4

the soil. Specific oxidants to be used in the treatability study are hydrogen peroxide and sodium persulfate. Soil samples collected in the field will be submitted to a laboratory for treatability analysis.

Aquifer Characterization

A slug test will be performed in monitoring wells MW-3 and MW-4 to determine the hydraulic properties of the saturated zone. Prior to conducting each slug test, a transducer / data logger will be installed in the well and used to monitor changes in water level during each test. Depth to groundwater will then be measured in the well. A water displacement device (the slug) will be set in the well beneath the water table, and left in place until the water table reaches static conditions. The slug will then be quickly removed from the well, while changes in water level are recorded over time. Water level monitoring will be continued until a minimum 90% water level recovery is achieved. This procedure will be conducted up to three times in each of the two wells.

Waste Handling

Soil generated during soil boring installation will be temporarily stored on site in approved DOT 17 E / H, 55-gallon drums, and properly disposed of based on analytical results.

Water used in the decontamination of equipment, tools, and all purge water will be contained in approved DOT 17 E / H, 55-gallon drums. The water will be transported to SHN's purge water storage tank, and be disposed of under permit, to the City of Eureka's wastewater collection system.

Equipment Decontamination Procedures

All equipment will be cleaned prior to bringing it on site. All drilling equipment will be cleaned between borings using a steam cleaner. All small equipment that requires on-site cleaning will be cleaned using the triple wash system. The equipment will first be washed in a water solution containing Liquinox® cleaner, followed by a distilled water rinse, then by a second distilled water rinse.

Laboratory Analysis

Each soil sample from the vadose zone will be analyzed for:

- Total Petroleum Hydrocarbons as Diesel (TPHD) and Total Petroleum Hydrocarbons as Gasoline (TPHG); in general accordance with EPA Method No. 8015M.
- Benzene, Toluene, Ethylbenzene, and total Xylenes (BTEX), and Methyl Tertiary Butyl Ether (MTBE), in general accordance with EPA Method No. 5030 / 8021B.

Two soil samples from the saturated zone will be analyzed for:

- Total Organic Carbon in general accordance with the Walkley-Black Method.
- Moisture content, porosity, and bulk density in general accordance with American Society for Testing and Materials (ASTM) Methods D-2216-92 and D-2937-94.

Selected soil samples will be submitted to a qualified laboratory for in situ chemical oxidation.

Each groundwater sample from the temporary well points will be analyzed for:

- TPHD, and TPHG in general accordance with EPA Method 8015M.
- BTEX and Fuel oxygenates in general accordance with EPA Method 8260B.

A sample analysis matrix is included as Table 1.

Table 1
Sample Analysis Matrix
Former Rio Dell Texaco, Rio Dell, California

Sample Location	Sample Type	Soil Sample Zone	TPHD & TPHG[1]	BTEX & FO[2]	ISCO[3] Bench Study	Physical Testing[4]
B-101	Soil	Vadose	X	X		
	Soil	Saturated				X
	Groundwater		X	X		
B-102	Soil	Vadose	X	X		
	Soil	Saturated			X	
B-103	Soil	Vadose	X	X		
	Soil	Saturated			X	
B-104	Soil	Vadose	X	X		
	Soil	Saturated				X
	Groundwater		X	X		
B-105	Soil	Vadose	X	X		
	Soil	Saturated				
	Groundwater		X	X		

1. Total Petroleum Hydrocarbons as Diesel (TPHD) and as Gasoline (TPHG).
2. Benzene, Toluene, Ethylbenzene, and total Xylenes (BTEX) and Fuel Oxygenates (FO)
3. ISCO: In Situ Chemical Oxidation
4. Physical testing includes moisture content, porosity, and bulk density.

During the May 2005 groundwater monitoring event, groundwater samples from site monitoring wells will also be analyzed for:

- dissolved iron and manganese in general accordance with EPA Method 200.9,
- nitrate and sulfate in general accordance with EPA Method 300.0, and
- alkalinity in general accordance with Standard Method 19th Edition 2320B.

Soil and groundwater samples for chemical analysis will be submitted to North Coast Laboratories Ltd., of Arcata, California. Soil samples for physical testing will be submitted to Daniel B. Stephens, of Albuquerque, New Mexico. The treatability study will be performed by Dr. Richard Watts at Washington State University or by Prima Environmental of Sacramento, California.

Report Preparation and Field Program Implementation

SHN will begin implementation of the field program upon receipt of approval from the HCDEH. The report of findings will be prepared for submittal to the HCDEH within sixty days of completing the investigation.

If you have any questions or if I can help in any way, please call me at 707-441-8855.

Sincerely,

SHN Consulting Engineers & Geologists, Inc.

Frans Lowman, R.G.
Project Manager

FBL/RMR:sjt:med

copy: Ms. Dorothy Bianchi

REGISTERED PROFESSIONAL GEOLOGIST
FRANS BARTON LOWMAN
NO. 6705
Exp. 6/30/05
STATE OF CALIFORNIA

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ITRC. (January 2005). *Technical and Regulatory Guidance for In Situ Chemical Oxidation of Contaminated Soil and Groundwater*. The Interstate Technology & Regulatory Council In Situ Chemical Oxidation Team. NR: NR.

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